

REMARKS

Claims 2, 17, 27, 29-30 and 32 have been amended. Claim 1 has been canceled without prejudice or disclaimer. Claim 2 has been amended to be in independent form, and claims 30 and 32 have been amended to include some features corresponding to claim 2. Dependent claims 27 and 29 have been amended to depend from claim 2. Claims 17 and 27 have been amended to correct clerical errors. New claims 33 and 34 have been added. No new matter has been added. Claims 2-34 are pending.

Rejections under 35 U.S.C. §§ 102 and 103

Claims 1-4, 7, 8, 10-13, 17, 18 and 27-30 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 6,412,276 to Salvat et al. (hereafter “Salvat”). Claims 5, 6, 19, 31 and 32 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Salvat in view of U.S. Patent No. 4,685,290 to Kamiya et al. (hereafter “Kamiya”). Claims 9, 14-16, 20, 21 and 26 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Salvat in view of U.S. Patent No. 6,804,952 to Sasaki et al. (hereafter “Sasaki”). Claims 22-25 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Salvat in view of U.S. Patent No. 6,796,118 to Kitahara (hereafter “Kitahara”). Applicant respectfully traverses these rejections for at least the following reasons.

Independent claim 2, amended to be in independent form, recites “a controller to control fuel injection to produce the preliminary combustion, and to control fuel injection to start the main combustion after an end of the preliminary combustion” and “wherein the combustion controlling actuator includes a fuel injector to inject fuel directly into a combustion chamber of the engine; and the controller is configured to perform a preliminary fuel injection to produce the preliminary combustion at or near top dead center, and to perform a main fuel injection to start the main combustion after the preliminary combustion is finished.” Thus, in claim 2, (1) the fuel injection is controlled to start a main combustion after being controlled to produce a preliminary combustion, and (2) the preliminary fuel injection is performed at or near top dead center. Salvat, which is relied on for disclosing the features of claim 2, fails to disclose either feature (1) or feature (2) as recited in claim 2.

Salvat discloses a regeneration system for regenerating a particulate filter 4 for a diesel engine. Salvat discloses a phase in which the engine is operated without assisted regeneration in FIG. 2, where the fuel is injected in two stages, a pilot injection I1 and a main injection I2 (col. 2, lines 56-60). Salvat also discloses a phase in which the engine is operated with assisted regeneration of the filter in FIG. 3, where the fuel is injected in three stages, I'1 to I'3. In contrast to claim 2, however, Salvat does not disclose starting main combustion after the end of a preliminary combustion.

Moreover, assuming for the sake of argument that the injection stages of Salvat could be considered to be a preliminary combustion followed by a main combustion after the end of a preliminary combustion, Salvat still does not disclose all the features of claim 2. Nowhere does Salvat disclose that a preliminary combustion should be produced at or near the top dead center. The objective of the injections in Salvat is to prolong combustion as long as possible (column 2, lines 61-67), but nowhere does Salvat suggest that a preliminary combustion should be produced at or near the top dead center. Salvat is not concerned with this feature of claim 2.

The remaining references of Kamiya, Sasaki, and Kitahara were cited for other features of the claims, but fail to cure the deficiencies of Salvat.

Kamiya discloses a control system to perform a filter preheating operation for increasing the temperature of a trapping filter 21 with a plurality of fuel injections as shown in FIG. 4. As is evident from FIG. 4, fuel injection is all performed after top dead center during the compression stroke in waveforms (2), (3) and (4) for the filter preheating operation.

Sasaki discloses a catalyst warm up control system for a diesel engine including a main catalyst 40. The control system is configured to perform pilot fuel injection and main fuel injection to achieve main combustion after pilot combustion as shown in FIG. 7B. Sasaki discloses, however, that the fuel injected by the pilot injection burns and releases heat ahead of top dead center TDC (col. 9, lines 62-63).

Kitahara discloses a NOx trap catalyst 13 for a diesel engine, a DPF 14, and a split injection mode, but makes no mention of the injection timings of a pilot injection and main injection.

In sum, even if Salvat were combined with Kamiya, Sasaki, and Kitahara, the combination would not suggest all the features of claim 2.

Independent claims 30 and 32, respectively recite “controlling fuel injection to produce preliminary combustion in an engine cycle by performing a preliminary fuel injection to produce the preliminary combustion at or near top dead center; and controlling fuel injection to start main combustion after an end of the preliminary combustion in the engine cycle” and “means for controlling fuel injection to the engine in a split combustion mode in response to the split combustion request by controlling fuel injection to produce preliminary combustion and controlling fuel injection to start main combustion after an end of the preliminary combustion, the means for controlling the fuel injection including means for performing the preliminary injection at such a timing as to cause a heat releasing process of the preliminary combustion to start before compression top dead center and to end after compression top dead center”, and are thus patentable for reasons analogous to claim 2.

The dependent claims are patentable for at least the same reasons as their respective independent claims, as well as for further patentable features recited therein.

Applicant believes that the present application is now in condition for allowance. Favorable reconsideration of the application as amended is respectfully requested.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by a check or credit card payment form being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to

charge the unpaid amount to Deposit Account No. 19-0741. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicant hereby petitions for such extension under 37 C.F.R. §1.136 and authorizes payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

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